

## Highlights

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# Washington SCIENCE TRENDS

**NUCLEAR AIRPLANE SHOWDOWN?** Leading Democrats on the powerful Joint Congressional Committee on Atomic Energy are on the verge of demanding that the Eisenhower Administration set a realistic target date for its Aircraft Nuclear Propulsion program or face a possible cancellation of the entire project. They bluntly declare that the annual expenditure of \$150 million constitutes nothing more than a "holding program" to avoid difficult technical and administrative decisions. This, they complain, is "a completely indefensible use of the taxpayers' money."

Congressional ire is chiefly directed against Deputy Defense Secretary Donald Quarles and James Killian, Jr., the President's science advisor. After twelve years of effort, the Democrats charge, the program "still has no firm set of objectives looking toward the development of a nuclear propelled aircraft" and no decision has been made regarding target dates. They privately place the blame on these two top Administration figures.

**ATOMIC INDUSTRY HEARINGS:** Joint Committee on Atomic Energy will survey the development, growth and state of the atomic energy industry at hearings scheduled for Feb. 17-19 and 24-26. Emphasis will be on development of a long-range power program. Sen. Clinton D. Anderson, (d) New Mex., Chairman, hopes that the public sessions will lead to a general agreement on future plans. Up for discussion will be the Committee's own staff recommendations, proposals by an AEC Ad Hoc Advisory Committee and the AEC's own programs.

There may be trouble ahead for industry representatives. Anderson says he wants to know why "the optimistic plans of industry spokesmen, as reflected in their past statements, have not come about."

Also scheduled for discussion: (1) The program for non-electric power applications for nuclear reactors, such as process steam and heating; (2) The declassification and dissemination of information; (3) The AEC's supporting services to the reactor industry, such as feed material and chemical reprocessing of used fuel; (4) AEC contract policy in the reactor development field; (5) Isotope development; (6) Maritime propulsion program and (7) Organizational, and administrative problems and bottlenecks in the AEC's reactor and industrial development field.

(Persons interested in submitting comments, or in testifying, should contact Mr. George F. Murphy, Jr., Joint Committee on Atomic Energy, F-88, The Capitol, Washington, D.C. by Feb. 13.)

## SPACE RESEARCH PROGRAMS

Here, from the Report of the President on the first year of the Space Age, are some of the highlights of research programs planned by the National Aeronautics and Space Administration (NASA) and the Advanced Research Projects Agency (ARPA) for the coming months. Projects described in recent issues of SCIENCE TRENDS are not generally included. Complete report is available free. See the Publication Checklist.

\* Atmospheres -- This program includes an intensive investigation of the structure and composition of the Earth's atmosphere, using sounding rockets and satellites. Particular emphasis will be placed on obtaining and understanding daily, geographic and seasonal variations, and their relationships between surface meteorology and the structure and dynamics of the upper atmosphere.

\* Ionospheres -- Here the object is to obtain electron density profiles at altitudes above the F-2 region (about 180 miles), using both sounding rockets and deep space probes. Latitude and time variations of electron density will be obtained by use of the polar-orbiting satellite beacon. The top-side sounding technique will be used in satellites. Very low frequency propagation measurements will be made in polar-orbiting satellites. Ion spectrum studies will be extended to the low mass numbers and higher altitudes by means of mass spectro-meters in both space probes and satellites. Direct measurements using antenna probes, ion probes, and electric field meters will be made in rockets and satellites to define in detail ionospheric structure and to study interactions between the ionosphere and space vehicles.

\* Energetic Particles -- In the energetic particles program, the interactions of high energy particles with the Earth's atmosphere and field will be studied intensively, and the types and energy of such particles and their special distribution will be measured. Specifically planned are measurements of: (1) cosmic ray intensity in interplanetary space; (2) time and latitude cosmic ray intensity variations; (3) composition and spatial extent of the Great Radiation Belt; (4) the cosmic ray energy and charge spectrums; and (5) the nature of the particles producing auroras.

\* Electric and Magnetic Fields.-- The program includes: (1) satellite investigations with proton magnetometers to study ring currents above the ionosphere and their relations to magnetic storms; (2) numerous sounding rocket experiments to investigate ionospheric currents; and (3) the use of magnetometers in space probes to observe electric currents and the form of the Earth's magnetic field at great distances, and to investigate whether the Moon has a magnetic field.

\* Gravitational Fields -- In this program, a carefully instrumented satellite will be launched into a very high orbit to obtain precise geodetic data over a long period of time. In addition, a highly accurate clock in a satellite will be launched into orbit to test the general theory of relativity.

\* Astronomy -- The program will continue and be expanded. The survey of nebulosities in the far ultraviolet -- a phenomenon discovered during the IGY -- will be extended to the southern sky by means of rockets. Particular emphasis will be placed on using scanning satellites and rockets to observe the previously unexplored infra-red and high-energy gamma ray spectral regions. Such studies will lay the groundwork for the satellite

observatory program. Solar ultraviolet and X-ray spectra will continue to be investigated, including long-term variations, line profiles, distribution across the disk of the Sun, and the spectrum of the coronal X-ray flux. Deep space probes will be used to determine the nature and extent of the solar nebula and the interplanetary medium. A scanning satellite will be undertaken at an early date to map the emission of the high atmosphere which derives from charged-particle interactions and photo-chemical reactions.

Through these activities NASA is expanding the scientific investigations required to provide better understanding of the total environment in which man and Earth exist. Many investigations must be made repeatedly to obtain a continuous picture of the space environment. For example, radiation and micro-micrometeor distribution must be measured again and again to chart their extent and to anticipate cycles of intensity and density, respectively.

The NASA program will include launchings of some 40 sounding rockets and their scientific payloads during 1959. Twelve complete satellite systems on order -- some for 1959 launchings -- will employ Jupiter, Thor-Able, and Atlas systems.

#### DEFENSE-ORIENTED

The military space program, administered by ARPA, includes a number of classified projects -- for example, very early warning network. Among major unclassified military space activities that ARPA directs are:

\* The Discoverer -- This project involves a series of vehicle launchings, chiefly from the Pacific Missile Range. Its purpose is further to develop new systems and techniques for production and operation of military space vehicles. The first launchings will be primarily to test the Discoverer vehicle and its subsystems, including propulsion and guidance. Later vehicles in the series will carry biomedical experiments to seek data on environmental conditions useful to Project Mercury.

\* Navigation Satellites -- The purpose of this project is to institute a precise, all-weather system for determining sea or air position anywhere on the globe. The navigation satellite will be valuable to aircraft, surface vessels, and submarines. The project passed from the planning to the active stage in September 1958. Several satellite tests under this program are planned for the first six months of 1959. The first will be a 150-pound, battery-powered package, expected to stay aloft about three months. Later versions will be larger and longer-lived.

\* Communications Satellites -- The first test of the concept was the instrumented Atlas rocket placed in orbit on December 18, 1958. Present military requirements for rapid, accurate, and secure communications demand minimum antenna and transmitting equipment, least possible interference from daily changes in solar conditions, and freedom from jamming. Several experimental communications satellites will be launched in the spring and summer of 1959. In 1960 or 1961, so-called "fixed" satellites are planned. These devices will maintain a fixed position over a given point, revolving at the same speed as terrestrial rotation, at a distance



of 26,000 miles from the center of the Earth. Three of these satellites could relay radio, television, and teletype messages continuously.

\* 1.5-Million-Pound Clustered Booster -- Work on this giant propulsion unit began August 15, 1958. Its purpose is to lift far greater payloads into orbit than so far have been possible. To form the booster, existing rocket engines and fuel tanks will be assembled in a cluster arrangement. By the end of 1959, present schedules call for ground-test firing of the cluster. Four booster test flights were ordered as part of the project.

\* High-Energy Upper Stage -- In September 1958, ARPA began developing a high-energy liquid propellant engine for the upper stage of space vehicles powered by ICBM rockets. By the end of the year, contracts had been let to major industries in the rocket propulsion field to develop the upper stage and the engine. The upper stage in conjunction with existing boosters should be able to place multi-ton payloads in orbit. Direction of this project goes to NASA on July 1, 1959. Flight tests are scheduled for late 1960 or early 1961.

\* Meteorological Satellite -- Reliable weather information is needed for military operations and for civilian activities too numerous to mention. The meteorological satellite project is seeking to fill gaps in present weather station networks by placing in orbit instrumented packages that can transmit rapidly over a large portion of the Earth's surface. They will be instrumented to detect and report cloud cover and temperature by infra-red radiation and other means. Systems responsibility has been assigned to the Ballistic Missiles Division of the Air Force and responsibility for the payload to the Army Signal Corps. Instruments and data analysis has been assigned to the Air Force Cambridge Research Center, Cambridge, Massachusetts.

Four meteorological satellites are scheduled for delivery in 1959. The Meteorological Satellite program is scheduled for transfer from ARPA to NASA, July 1, 1959, and a launching is planned for fall or early winter. Six more packages will be used in laboratory and other environmental tests. NASA and the U. S. Weather Bureau are already taking part in the program.

\* Tracking -- In May 1958, the Army and Navy began developing a mini-track-DOPLOC (Doppler) fence across the Southern United States to establish a system for detecting non-radiating satellites. The network should begin operating experimentally in January 1959. A computing and filtering center is being developed at the Air Force's Cambridge Research Center. ARPA is coordinating this entire tracking effort with other Government programs to avoid duplicating major activities.

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NASA CLOSES OFFICE: Space Administration will close its long-established liaison office at Wright-Patterson Air Force Base about April 1. Officials explain that contact with the Air Research and Development Command will be handled through a number of other existing channels. William J. Underwood, who has been heading the Dayton, Ohio office, will come to Washington as assistant to the Chairman of the civilian-military space liaison committee at the Pentagon.



NEW RESEARCH GROUPS: Expanded research and development service in the fields of radio communication and guidance systems for ballistic missiles and space vehicles is forecast by the Boulder Laboratories, National Bureau of Standards, Boulder, Colo.

Here, for reference, are new organizations at Boulder:

- \* Lower Atmospheric Physics, a research section which will perform basic studies expected to be of benefit in the development of guidance systems. A staff of 12 will be directed by Dr. Moody C. Thompson, Jr.
- \* Radio Communications and Systems, a new division which will be chiefly concerned with research in radio communications and navigation techniques and application of radio propagation studies to the design and improvement of radio systems. R.C. Kirby of the Boulder Radio Physics division will head the new division.

BIO-ASTRONAUTICS: An Armed Forces-National Research Council Committee has been formed to advise the armed forces, upon their request, on any matter concerning the biological or medical aspects of space exploration. The committee will concern itself with any field of science or of technology that it finds necessary in pursuit of its objectives, including pertinent aspects of astronautics, biology, chemistry, medicine, physiology, psychology and related interdisciplinary sciences.

Full Committee will consist of more than 100 members, at least half from the military. Here, for reference, are the members of the new Executive Council:

Chairman -- Dr. Detlev W. Bronk, President of the National Academy of Sciences. Vice-Chairman -- Dr. Otto H. Schmitt, Department of Physics, University of Minnesota. Also, Dr. Melvin Calvin, University of California; Dr. Howard J. Curtis, Brookhaven National Laboratory; Dr. Paul M. Fitts, University of Michigan; Brig. Gen. Don D. Flickinger, Air Research and Development Command; Dr. John D. French, University of California Medical Center, Los Angeles; Capt. Charles F. Gell, Office of Naval Research; Dr. James D. Hardy, U.S. Naval Air Development Center, Johnsville, Pa., and Col. Robert H. Holmes, Office of Surgeon General, U.S. Army.

AVIATION RESEARCH: Two new appointments at the Federal Aviation Agency. Deputy Director, Bureau of Research and Development will be Capt. Alden C. Packard, former Director of the Anti-Submarine Warfare Laboratory, Johnsville, Pa. New Chief of the FAA Airports Division will be George R. Borsari, who held a similar post at the Civil Aeronautics Administration.

GOVERNMENT PROCUREMENT: New Government-wide procurement regulations just announced should aid contractors dealing with Federal agencies. They are designed to simplify existing procedures or eliminate inconsistencies or inequities. The regulations:

- \* Establish a uniform procedure for setting aside Government procurements for award exclusively to small business concerns.
- \* Establish new ground rules under which late bidders will have an opportunity to show that their bids were mailed in time.
- \* Provide new standard contract forms for Government-wide use for small construction or repair contracts, up to \$10,000.

## RESEARCH CHECKLIST

( ) AVIATION WEATHER SERVICE: Air Force is seeking bids for a research and development program aimed at modernizing aviation weather service. The proposed contract calls for a test facility involving approximately nine civilian and military airports and a data processing center. The contractor will use these test facilities to conduct equipment and system tests, obtain cost data and furnish information for the procurement and installation of equipment.

E. R. Quesada, Administrator, Federal Aviation Agency, proposes establishment of a Board of Advisors comprised of senior Government weather officials to monitor the conduct and progress of this and related programs.

(Prospective bidders on the weather system may obtain additional information from Air Research and Development Command, Communication Systems Office, 424 Trapelo Road, Waltham, Mass. Interested contractors should notify the Commander, Rome Air Materiel Area, Griffis AFB, N.Y. of their intention to bid.)

( ) NEW BEACON LIGHT: Army Engineers are testing a new lightweight and air-droppable pathfinder beacon light designed to mark assembly points for airborne troops. An infrared range of two miles is claimed for ground viewers and a five mile visible light range is claimed for viewing from a 1,000-foot altitude. A coding mechanism permits a pre-coded sequence of four Morse code characters to be displayed on six signal lenses.

( ) LENS DISTORTION: Investigations sponsored by the Air Force have led to the conclusion that the two methods generally used today to measure lens performance give better results than previously believed possible. The experimental results reported by the National Bureau of Standards are expected to lead to increased accuracy in calibrating both the cameras and the lenses used in aerial mapping from photographs.

(Report available free. Write National Bureau of Standards, Office of Technical Information, Washington 25, D.C. for Summary Technical Report No. 2314.)

( ) SELF-LUMINOUS LIGHT SOURCES: Investigations at the Naval Research Laboratory indicate that self-luminous light sources excited by the radio active isotope krypton-85 have "attractive" potentials for low-level illumination at Navy fleet, air and shore installations. Radioactive hazards were assessed and found negligible. Flashlights, aircraft drogue lights, lanterns, warning signs and emergency equipment markers have been fabricated.

(Details from Optics Branch, U.S. Naval Research Laboratory, Washington 25, D.C.)

( ) PRESSURE DEVICES: Research for the Wright Air Development Center has led to development of an experimental mercury-column standard for calibrating pressure-measuring devices used in military aircraft. The mercury manometer employs capacitance measurement as a means of sensing the height of its mercury columns, at altitudes above 60,000 feet.

(Report available free. Write National Bureau of Standards, Office of Technical Information, Washington 25, D.C. for Summary Technical Report No. 2313.)

( ) RADIATION AND COAL: Investigations sponsored by the U.S. Bureau of Mines include the exposure of hard coal samples to high doses of radiation at the Curtiss-Wright nuclear reactor, Quehanna, Pa. The studies are designed to demonstrate the effects of radiation on the physical and chemical properties of anthracite. It is hoped that fundamental knowledge of this type might enable government and industry to develop new approaches to the problem of increasing anthracite utilization. Reports on preliminary results are expected in the near future.

( ) NEW BATTERY SYSTEM: Investigations by Sprague Electric Co., for the U.S. Army have led to the development of a cell system said to be feasible for commercial production. The research was directed toward a solid electrolyte battery which would give longer shelf-life and a small physical size. A novel cup-shaped cell was also developed.

(Details from OTS, U.S. Department of Commerce, Washington 25, D.C. Order PB 131 796. 280 pages. \$4.)

( ) NEW ANALOG COMPUTER: Research at the National Bureau of Standards has led to development of an electronic analog device said to solve transient heat problems. It can be used to estimate the fire endurance of structural building elements. The device is said to be based on the similarity between current flow in electrical circuits and conductive heat flow in thermal circuits.

(Report available free. Write NBS, Office of Technical Information, Washington 25, D.C. for Summary Technical Report No. 2265.)

( ) RADAR DISPLAY: Research for The Air Force has led to the first announced photographs of a conventional radar display from stratospheric altitudes. A balloon-lofted instrumented radar gondola was used in a joint project performed by Goodyear Aircraft and Winzen Research. Three flights are planned. Air Research and Development Command reports that the photographs show an aerial radar view in plan position form, rather than the view as seen in conventional photographs.

( ) SATELLITE TRACKING: Russian scientists, according to reports received in Washington, believe that the location of a satellite can be determined within an accuracy of 2-3 seconds of an arc by use of a "blinking" light. The Russians agree with U.S. researchers that a pulse gas-discharge lamp, similar to those used in photography, is the most promising light source. It is noted that sharp temperature fluctuations will require the development of special condensers.

( ) ATOMIC SHELTER: U.S. Army has developed and tested an underground shelter of corrugated steel for protection against atomic weapons effects in overseas theaters of operations. Tests with conventional explosives indicate the structure can withstand blast effects of up to 60 pounds per square inch. Steel plates are bolted together in the shape of a parabolic arch. A blast arrestor of rocks is patterned after a Swedish design.

( ) ALLOY RESEARCH: Investigations at the Naval Research Laboratory indicate that an adjustment in the manufacturing techniques for sintered metal powder (SAP) alloys may lead to materials with greater tensile strength and ductility.

(Report available. Write OTS, U.S. Department of Commerce for PB 151 047. 4 pages. 50 cents.)



### PUBLICATION CHECKLIST

- ( ) Space Law, a comprehensive selection of articles, papers and other material relating to U.S. and foreign views of legal problems and outer space. 573 pages. Free. (Write Special Committee on Space and Astronautics, Senate Office Building, Washington 25, D.C.)
- ( ) Antenna Gain, A National Bureau of Standards study of techniques for the accurate measurement of antenna gain. Special features of the instrumentation, including methods for minimizing and measuring matching losses, are described. 10 pages. 15 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for NBS Circular 598.)
- ( ) Commerce Report, the annual report of the U.S. Department of Commerce, including material on such agencies as the Weather Bureau, Coast and Geodetic Survey, Patent Office and National Bureau of Standards. 92 pages. 35 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Commerce Department, 46th Annual Report.)
- ( ) Thermometers, a National Bureau of Standards summary of the problems involved in the calibration of so-called liquid-in-glass thermometers. Covers, design, use and methods of calibration. 21 pages. 20 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for NBS Circular 600.)
- ( ) Bearings, a bibliography prepared by the U.S. Naval Avionics Facility containing more than 400 annotated references concerning all phases of precision instrument ball bearings and fluid bearings. The material was prepared following an extensive industry survey. 103 pages. \$2.50. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for Report PB 131 791.)
- ( ) Food and Drug Scientists, an illustrated recruiting brochure describing employment opportunities in Washington and 17 other major cities. 22 pages. Free. (Write Information Office, Food and Drug Administration, Washington 25, D.C.)
- ( ) Space Administration Employment, an illustrated brochure sketching employment opportunities with the National Aeronautics and Space Administration in Washington and at various research centers. (Write NASA Employment, 1520 H Street, N.W., Washington 25, D.C. for "Career Countdown.")
- ( ) Metallurgy, various reports now available on research sponsored by National Academy of Sciences. (Write Ship Structure Committee, National Academy of Sciences, Washington 25, D.C. for Report No. SSC-115, Brittle Fracture Initiation Tests; SSC-114, Ferrite Banding, and SSC-42, Initial Stresses in Steel Plates.)
- ( ) Space Age-Year One, The Report of the President on U.S. military and civilian projects connected with aeronautics and space over the past year. Also contains summary material on plans and programs for the future. 53 pages. Free in limited quantities. (Write Information Office, NASA, 1520 H Street, N.W., Washington 25, D.C.)

